

Appln. No. 09/544,629
Amdt. dated May 24, 2004
Reply to Office Action of November 24, 2003

REMARKS/ARGUMENTS

Reconsideration of the present application, as amended, is respectfully requested.

The November 24, 2003 Office Action and the Examiner's comments have been carefully considered. In response, claims are amended and added, and remarks are set forth below in a sincere effort to place the present application in form for allowance. The amendments are supported by the application as originally filed. Therefore, no new matter is added.

PRIOR ART REJECTIONS

In the Office Action, claims 1 and 3-4 are rejected under 35 USC 103(a) as being unpatentable over JP 9-13172 (Arai Susumu et al) in view of USP 5,982,187 (Tarzwell). Claim 2 is rejected under 35 USC 103(a) as being unpatentable over Arai Susumu et al. in view of Tarzwell, and further in view of JP 08-181083 (Shin Taira et al.).

In response, claims 1 and 4 are amended to more clearly define the present claimed invention over the cited references. In addition, claims 9-13, which are either directly or indirectly dependent on claims 1 or 4 further define and limit the inventions defined by claims 1 and 4.

The present claimed invention as defined by independent claim 1 is directed to a wafer holding device for use in an apparatus for treating a principal surface of a semiconductor wafer under a predetermined heating condition while the back surface of the principal surface of the wafer is held by the device at a predetermined position within a chamber of the apparatus. The device includes a susceptor formed in the surface thereof with a wafer loading area for supporting the back surface of the wafer, a plurality of support pins each arranged at one of four equiangularly spaced positions along a circumference of each of a plurality of concentric circles in the wafer loading area so as to protrude from the surface of said susceptor, and a resilient mechanism made from quartz for supporting said support pins.

In the claims, claims 1 and 4 are amended by replacing "at least one concentric circle" with -- each of a plurality of concentric circles --. The amendment of claims 1 and 4 and new claims 9-13 are fully supported by the present application at page 18, lines 7-14 and Figs. 1-3. Therefore, no new matter is added. In addition, the improved results obtained by the claimed invention are explained on page 19, lines 19-26 of the present application.

JP 9-13172 (Arai et al.) disclose a CVD apparatus with a wafer supporting mechanism containing four lift pins 41 provided so as to be vertically passed through the peripheral part of the wafer holder 34. The four lift pins 41 are placed equiangularly along a circumference of only one circle in the wafer loading area of the holder 34, as clearly shown in Fig. 2 of Arai et al.

USP 5,982,187 (Tarzwell) discloses a resilient connector or probe for making electrical connections to printed circuit boards for testing. The probe includes a resilient spring cut from a quartz tube.

In rejecting claims 1 and 3-4 the Examiner admits that Arai et al. do not disclose a resilient member made from quartz. In order to bridge the gap between claims 1 and 4 and Arai et al., the Examiner cites Tarzwell as disclosing a resilient spring cut from a quartz tube.

Arai et al. do not, however, disclose a plurality of support pins each arranged at one of four equiangularly spaced positions along a circumference of each of a plurality of concentric circles in the wafer loading area so as to protrude from the surface of the susceptor as now recited in amended claim 1.

Tarzwell does not disclose a quartz spring for resilient support of a wafer support pin used in the wafer holder or susceptor. Therefore, even if both references are taken in combination, it would not have been obvious to one having ordinary skill in the art at the time the invention was made to form a wafer holding device including a plurality of support pins each arranged at one of four equiangularly spaced positions along a circumference of each of a plurality of concentric circles in the wafer loading area so as to protrude from the surface of the susceptor as now recited in amended claim 1.

In view of the foregoing, claims 1 and 4 are patentable over the cited references under 35 USC 102 as well as 35 USC 103.

Claim 3 is dependent on claim 1 and is patentable over the cited references in view of its dependence on claim 1 and because the references do not disclose, teach or suggest each of the limitations set forth in claim 3. In view of the foregoing, claim 3 is patentable over the prior art of record under 35 USC 102 as well as 35 USC 103.

With regard to the rejection of claim 2, the Examiner combines Arai et al. in view of Tarzwell, and further in view of Taira et al.

Claim 2 further defines and limits the invention of claim 1 and recites that in the wafer holding device, the support pins are disposed in a position which supports the wafer along the crystal orientation with respect to the crystal plane of the wafer.

In rejecting claim 2 the Examiner admits that Arai et al. do not explicitly disclose that the support curves in a certain orientation. In order to bridge the gap between the present claimed invention as defined by claim 2 and Arai et al., the Examiner cites Taira et al. and contends that the reference discloses a thermal processing apparatus and lift pin support according to (110) direction with respect to plane 100 of the wafer. As a result the Examiner contends that it would have been obvious to one of ordinary skill in the art at the time the invention was made to orient the support pins for (110) direction so as to reduce the problem of slip.

Arai et al. disclose a CVD apparatus with a wafer supporting mechanism containing four lift pins 41 provided so as to be vertically passed through the peripheral part of the wafer holder 34. The four lift pins 41 are placed equiangularly along a circumference of only one circle in the wafer loading area of the holder 34, as clearly shown in Fig. 2 of Arai et al.

Tarzwel discloses a resilient connector or probe for making electrical connections to printed circuit boards for testing. The probe includes a resilient spring cut from a quartz tube.

Taira et al. disclose a thermal processing apparatus using a plurality of vertical supports 11 for vertically supporting a silicon wafer in accordance with (110) direction with respect to plane (100) of the wafer.

Arai et al. do not, however, disclose a plurality of support pins each arranged at one of four equiangularly spaced positions along a circumference of each of a plurality of concentric circles in the wafer loading area. Tarzwel does not disclose a quartz spring for resilient support of a wafer support pin used in the wafer holder or susceptor. Taira et al. do not disclose a plurality of support pins each arranged at one of four equiangularly spaced positions along a circumference of each of a plurality of concentric circles in the wafer loading area. Even if these references are taken in combination, it would have not been obvious to one having ordinary skill in the art at the time the invention was made to use a plurality of support pins each arranged at one of four equiangularly spaced positions which support the wafer along the crystal orientation (110) with

respect to the crystal plane (100) of the wafer on a circumference of each of a plurality of concentric circles in the wafer loading area in order to uniformly and stably support a large-diameter semiconductor wafer of 400 mm or over in diameter by the large number of support pins on the wafer back surface with the reduced local loading/decreased stress at the respective supporting points where the mechanical strength of the wafer is high from the physical property point of view.

In view of the foregoing, claim 2 is patentable over the cited references under 35 USC as well as 35 USC 103(a).

NEW CLAIMS

New claims 9-13 are added to the present application. Claims 9-13 are either directly or indirectly dependent on claims 1 and 4 and are patentable over the cited references in view of their dependence on claims 1 or 4 and because the references do not disclose, teach or suggest each of the limitations set forth in new claims 9-13.

It is respectfully believed that no additional fees are due for the presentation of claims 9-13 since the present application does not include more independent or total claims above the highest number of independent and total claims for which payment

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was previously made. However, if any additional fees are due, please charge our Deposit Account No. 06-1378 for such sum.

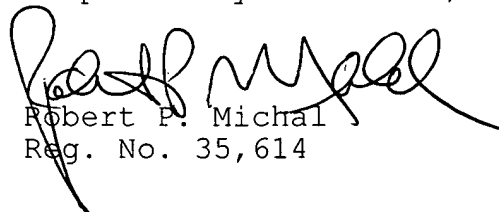
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If the Examiner disagrees with any of the foregoing, the Examiner is respectfully requested to point out where there is support for a contrary view.

Entry of this Amendment, allowance of the claims, and the passing of this application to issue are respectfully solicited.

If the Examiner has any comments, questions, objections or recommendations, the Examiner is invited to telephone the undersigned at the telephone number given below for prompt action.

Respectfully submitted,


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Encl.: Petition for Extension of Time